Review of Vermont's Power Outages From the October 25 & 26, 2005 Storm A Preliminary Report

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VERMONT

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Introduction

On October 25 and 26, 2005, a severe snow storm struck nearly the entirety of Vermont resulting in numerous and lengthy electric power outages. On November 4, 2005, Governor Jim Douglas called on the Department of Public Service "to conduct a thorough review of the root causes of [these] outages, evaluate the response by the utilities and the state, and recommend actions that may be necessary to alleviate the effects of future outages." This report provides the Department's preliminary results of its review, addresses the weather event of October 25 and 26 in context, examines the root causes for the severity of the resulting power outages, lists elements comprising superior utility response to such events, and evaluates the effectiveness of the communication between the utilities and their customers during this event. This report also provides preliminary observations regarding the effectiveness of Vermont's utilities' responses to the storm and the role of state government in such events. As to these latter aspects, the Department's review is continuing. A final report addressing the effectiveness of the utilities' responses, the role of state government in such events, and lessons learned will be issued in first quarter 2006.

The Storm of October 25 & 26, 2005

The weather during October 2005 was unusually warm and rainy. October 25th arrived with a large percentage of the state's trees still holding onto their leaves and the soils saturated and weakened. Many Vermonters commented that "autumn was late to arrive." Daytime temperatures on October 25 and 26 were in the upper 20s and low 30s; the wind was light.

On Tuesday, October 25th, a classic Noreaster and the remnants of Hurricane Wilma converged into one of the most severe storms in memory. Morning rain changed to sleet and then to extremely heavy, wet snow. Accumulation in most parts of the state was heavy, including up to 14 inches of snow in sections of the Northeast Kingdom. From the perspective of utility operators, this storm caused more damage than either the January 1998 ice storm or the September 1999 storm in the wake of Hurricane Floyd. Many commented that the storm was reminiscent of the infamous October 1987 snow storm that occurred during peak foliage season and resulted in severe damage to utility infrastructure and numerous power outages.

The Power Outages

Vermont is served by 21 distinct electric distribution utilities and one transmission utility. The service territories of these utilities share in the characteristics of Vermont itself, i.e., they are predominantly rural in nature with relatively few customers per distribution line-mile and with a significant exposure to trees, higher elevations, and severe winter weather. The exposure of the distribution infrastructure to trees, combined with the trees retaining their leaves, extremely heavy - wet snow, low wind speed, and saturated and weakened soils set the stage for the power outages. Two modes of outages predominated. First, tall (40 ft. to 60 ft.) small diameter (3" to 5") trees, heavily laden with snow, bowed over into nearby power lines resulting in short circuits and conductor breakage. Second, larger trees, often from outside of the right-of-way and also heavily laden with snow, were uprooted into nearby power lines resulting in conductor breaks and pole and crossarm failures - all resulting in power outages.

Over 100,000 customers, nearly one-third of the state, experienced a power outage during this event. Many customers experienced multiple outages. Preliminary estimates are that over 1000 wires were brought down and nearly 100 poles and crossarms broken. Trees bowed over or uprooted likely numbered in the thousands. Most customers were returned to service within the first 48 hours. However, a large number of customers experienced outages lasting three days or more. The last customer was restored to service at 9:00 PM on Sunday, October 30, five days after the storm struck. Total state-wide restoration costs may have exceeded $3 million.

Effective Response to Storms

The ability of an electric utility to effectively and efficiently respond to a severe storm and restore customers to service is dependent on a number of elements. Some of the elements of effective storm response include the following:

Storm plans. Written, comprehensive, and updated storm plans accompanied by periodic employee training are essential. Such plans include the specific responsibilities of employees during a storm event and contain listings of line crews, mutual aid crews, contract tree crews, key customer contacts, media contacts, restaurants, fuel depots, town emergency phone numbers, hazardous spill response, equipment suppliers, emergency generator locations, key state and local agencies, communications protocols, and cell phone and pager numbers.

Weather forecasts and early notification. Advance notice of an impending storm permits utilities

to contact employees, prepare secondary assignments, determine crew availability, and review equipment availability.

Vegetative management. Outages from storms often involve tree contacts. Effective vegetative management (tree trimming) can result in fewer tree contacts and more efficient restoration.

Pole inspection and treatment. Routine pole inspections and treatment remove weak structures from electric systems thereby allowing the systems to endure the mechanical stresses brought on by storms.

System maps. Updated and accurate system maps showing line, switch, and equipment locations are critical to the efficient dispatch and utilization of line crews.

Customer education. Utility customers are better able to cope with storm-related outages when informed about effective storm preparation, preparation for special and medical needs, and the limits of utilities to provide uninterrupted power.

Customer communication. Utilities have technological systems and personnel to handle outage reporting by customers in a timely manner. Personnel are trained in the handling of outage call-taking and have access to accurate information from operations about outage status. Media communications is handled in a manner that provides frequent updates to local radio, television and print media, minimizing the need for multiple calls to the utility for status updates.

Road-side location of distribution lines. Distribution lines located alongside roads, as opposed to located cross-country, can be reached by crews more quickly, restored using bucket trucks, and brought back into service more efficiently.

Mutual aid and contract crews. Utilities can expedite restoration by using crews from other utilities under mutual aid agreements and by hiring contract crews.

Secondary assignments. Training and utilization of employees that do not usually work in operations can provide valuable assistance to operations staff. For example, the use of field engineers, knowledgeable staff, and retirees to perform line patrols (so-called "bird-dogging") can free-up crews to concentrate on line restoration.

Road crews. Restoration is often hampered by snow-bound and tree-blocked roads. Communication with, and utilization of town and state road crews can aid in timely restoration.

Vermont Utilities' Response to the Storm

The Department's assessment of the response of Vermont's electric utilities to the storm of October 25 and 26, 2005 is on-going and will be reported in detail in first quarter 2006. However, based on the investigation to date, several preliminary observations can be made.

Vegetative Management. As described above, effective vegetative management generally results in fewer tree contacts and more efficient restoration of downed lines. For this storm, the factors of a relatively warm October, leaves on the trees, saturated and weakened soils, little wind, and up to 14 inches of heavy-wet snow conspired to place extreme stress on the trees in the state. These trees, in turn, fell into and damaged electric utility lines and structures causing the vast majority of the outages. Whether the resulting power outages are evidence of poor vegetative management on the part of Vermont's utilities, however, is not entirely clear. After preliminary investigation into the matter, several schools of thought emerge:

On the one hand, the events of October 25 and 26 may, in fact, be evidence of the need for more aggressive vegetative management. As background, most distribution lines in the state are placed within 50 foot rights-of-way, allowing, in theory, up to 25 feet of horizontal clearance between distribution lines and the nearest trees. In practice, however, tree trimming is often limited to 10 to 15 feet of horizontal clearance between the lines and trees. This limitation mainly arises from two sources. First, economic tree-trimming cycles for distribution lines are commonly in the range of 5 to 10 years. The growth of tree branches horizontally in Vermont usually will not exceed 10 to 15 feet during this period. And second, trees are seen as a significant part of the Vermont aesthetic. Land owners and the public are often reluctant to support the trimming or removal of trees that act as visual screens between residences and utility lines and that provide much of Vermont's visual beauty. Despite these challenges, however, one conclusion is that extensive outages from this type of storm can only be prevented if more extensive tree trimming is permitted, supported, or even mandated. As support for this idea, one can point to the VELCO transmission system which generally maintains 150 foot rights-of-way with trees cleared to the maximum of 75 feet away from the lines. The VELCO transmission system experienced only one outage during the October storm. Quite simply, one conclusion that could be made is that more extensive tree trimming would likely result in fewer tree-related outages.

A second school of thought, however, disputes this notion as overly simplistic. First, it is noted

that, for this storm, most of the trees that made contact with distribution lines were tall, thin, and bowed over at the trunk; many wholly uprooted; a significant number of trees were in areas that were recently trimmed; and many of the trees came from outside of the right-of-way. Given these circumstances, more extensive trimming may provided limited benefit. Also, distribution lines, by their very nature, are close to the customers served. Because Vermonters are keenly interested in the aesthetic qualities of the state and their neighborhoods, clearing distribution line rights-of-way of trees on a scale that would be required to "storm-proof" the lines would likely be highly objectionable.

A third view of the issue recognizes that while extensive tree trimming may be difficult and of limited value in preventing contacts of trees on lines for this type of storm, the absence of basic tree trimming can make restoration of downed lines more difficult and time consuming. This may be true because lines that have fallen in trimmed rights-of-way will fall to the ground in narrow clearings where they are easily accessed by line crews. On the other hand, lines that come down in rights-of-way in need of trimming become entangled in trees and are much more difficult to access and repair. There is some evidence that parts of the state are lacking in even basic tree trimming which may, at the least, have exacerbated the restoration efforts from the storm.

Utilization of Personnel. The Department's preliminary investigation indicates a commendable level of dedication and hard work on the part of electric utility employees to respond to the storm. Many employees worked multiple 18 and 20 hour days to restore service to customers. A number of Vermont line crews, after working long hours to restore service to their own customers, traveled to neighboring utilities to provide assistance in the form of mutual aid. There was extensive use of line crews from outside the state as well as utilization of contract tree crews. At the same time, it is not clear that all mutual aid crews or contract tree crews, when available, were utilized as effectively as possible. Preliminary indications are that in some cases, a lack of storm planning, incomplete utilization of secondary assignments, and a failure of coordination interfered with the optimal use of available personnel.

Communications. The effectiveness of utility communications efforts varied across the state. In some cases, effective systems were in place to handle customer call volume, provide accurate status reports, and communicate effectively with local media. In other cases, the large number of

outages overwhelmed utility call handling resources during the height of the outage, and the media were not universally used to full advantage.

System Mapping. In the area of system mapping, the results are mixed. For some utilities, extensive electronic mapping coordinated with computerized outage management systems aided in the response and restoration. Conversely, for other utilities, a lack of system maps appear to have resulted in some confusion and the hampering of restoration efforts.

Storm Plans and Training. Similarly, in the area of updated storm plans and training in storm response, the results among Vermont's utilities are mixed. While some utilities clearly benefitted from having up-to-date storm plans, not all utilities had updated plans from which to base their restoration efforts. In at least one case, the restoration of a major transmission line appears to have been unnecessarily delayed when crews were held back under the mistaken assumption that the particular problem originated from outside of the state.

Utility-State Coordination

Among the preliminary findings of the Department is the need for better coordination between utilities and state agencies during major storms. For example, it is evident that at times utility line crews were unable to travel to power lines because roads were blocked by snow and downed trees. The state, through the resources of Vermont Emergency Management, could be used to coordinate road-crews for the purpose of quickly reaching important lines. Information on the availability of shelters, portable generators, and other emergency services could similarly be coordinated. Enhanced coordination among the utilities themselves could provide benefits in responding to emergencies.

At the request of the Commissioner of the Department of Public Service, a utility-state working group was formed in November 2005 for the purpose of better preparing and coordinating utilities and the state to respond to storms and other severe weather events. This group, under the leadership of the Vermont Electric Power Company and Green Mountain Power Corporation, has met numerous times over the past several months in an effort to better coordinate the emergency response of the state's transmission utility, distribution utilities, the Department of Public Service, and Vermont Emergency Management. A one-day drill for the purpose of coordinating the response to cold-weather induced power shortages was held in December 2005. Similarly, efforts to coordinate the response to major storm events is underway. A drill for the purposes of responding to storm-induced outages is being planned for first quarter 2006.

Next Steps

The Department's investigation and assessment of the utilities' response to the storm of October 25 and 26, 2005 is on-going. This investigation will include detailed questionnaires to be sent to all Vermont electric utilities in the coming weeks together with follow-up interviews with utility operators and labor representatives. Of particular concern will be the level of vegetative management employed throughout the state, the question of whether enhanced vegetative management would be effective in alleviating outages from this type of storm, and whether Vermont's electric utilities are using best practices for preparing and responding to storm events. A final report on these aspects will be issued by the Department in first quarter 2006.